

Mathematics Class X
Chapter -4
Quadratic Equations
Module - 2/3

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Learning outcomes in module 2/3
are:

- ❖ Roots / Zeroes of a Quadratic Equation.
- ❖ Solution of a Quadratic Equation by Factorisation.

Roots/Zeroes of a Quadratic Equation:

- A real number α is called a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ if $a\alpha^2 + b\alpha + c = 0$.

Example: Consider the quadratic equation $x^2 - 8x + 12 = 0$. If we replace x by 2 on the LHS of this equation, we get $2^2 - (8 \times 2) + 12 = 0 = \text{RHS}$ of the equation. We say that 2 is a root of the quadratic equation $x^2 - 8x + 12 = 0$. This also means that 2 is a zero of the quadratic polynomial $x^2 - 8x + 12$.

To Be Remembered

- The **zeroes** of the quadratic polynomial $ax^2 + bx + c$ and the **roots** of the quadratic equation $ax^2 + bx + c = 0$ are the **same**.
- A quadratic polynomial can have at most two zeroes. So, any quadratic equation can have at most two roots.

Solution of a Quadratic Equation by Factorisation

- We first write the given quadratic equation as product of two linear factors by splitting the middle term.
- By equating each factor to zero we get possible solutions/roots of the given quadratic equation

For Example: Find the roots of the equation $x^2-5x+6=0$ by factorisation.

- **Solution:** Let us split the middle term

$$x^2-3x-2x+6=0$$

$$x(x-3)-2(x-3)=0$$

$$\text{i.e, } (x-3)(x-2)=0$$

$$\text{Put } x-3=0, x=3 \text{ \& } x-2=0, x=2$$

- So, $x=2$ & $x=3$ are solutions of the given equation.

Questions for Practice.

Solve the following by factorisation:

1. $x^2 + 11x + 30 = 0$

2. $x^2 + 18x + 32 = 0$

3. $x^2 + 7x - 18 = 0$

4. $x^2 + 5x - 6 = 0$

5. $y^2 - 4y + 3 = 0$

6. $x^2 - 21x + 108 = 0$

7. $x^2 - 11x - 80 = 0$

8. $x^2 - x - 156 = 0$

9. $z^2 - 32z - 105 = 0$

10. $40 + 3x - x^2 = 0$

Divide 27 into two parts such that sum of their reciprocals is $\frac{3}{20}$.

Solution: Let one part be x & another part be $27-x$

$$\text{So, } \frac{1}{x} + \frac{1}{(27-x)} = \frac{3}{20}$$

$$\frac{(27-x+x)}{(x(27-x))} = \frac{3}{20}$$

$$180 = x(27-x)$$

$$x^2 - 27x + 180 = 0$$

$$(x-15)(x-12) = 0$$

$$x = 15, x = 12$$

So, two parts are 15 & 12

A speed of a boat in still water is 11 km/hour .It can go 12 km upstream & return downstream to the original point in 2 hours 45 minutes . Find the speed of the stream.

Solution: Let the speed of the stream be x km/h

Speed of the boat in still water – 11 km/h

\therefore Upstream speed= $11-x$ km/h & downstream speed = $11+x$ km/h

Distance = 12 km

Time taken to travel downstream = $12/(11+x)$ hours

Time taken to travel Upstream = $12/(11-x)$ hours

ATQ, $12/(11+x) + 12/(11-x) = 2 \frac{3}{4}$

After simplification, $x^2 = 25$

$\therefore x = \pm 5$

Hence, speed of the stream = 5 km/h

A 2-digit number is such that product of its digits is 18 .When 63 is subtracted from the number , the digits interchange their places. Find the number.

Solution: Let digit at unit's place = x & digit at ten's place = y

$$\therefore \text{Number} = 10y+x$$

$$\text{ATQ, } xy = 18$$

$$\therefore y = 18/x$$

$$\& 10y+x-63 = 10x+y$$

$$\text{Or, } 9y-9x-63 = 0$$

$$\text{Or, } y-x-7 = 0$$

replacing $y = 18/x$ in the above equation we get, $18/x -x-7 = 0$

$$18-x^2 -7x = 0$$

$$X^2 +7x-18=0$$

$$(x+9)(x-2) = 0$$

$$X = -9, x=2$$

When $x=2$, $y = 18/2 = 9 \therefore \text{Number} = 92$.

A takes 6 days less than the time taken by B to finish a piece of work . If both A & B together can finish it in 4 days ,find the time taken by B to finish the work.

Solution: Let the number of days taken by B to finish the work = x

\therefore Number of days taken by A to finish the work = $(x-6)$

Number of days taken by A & B together = 4

Now, A's one day work + B's one day work = one day's work of A & B together.

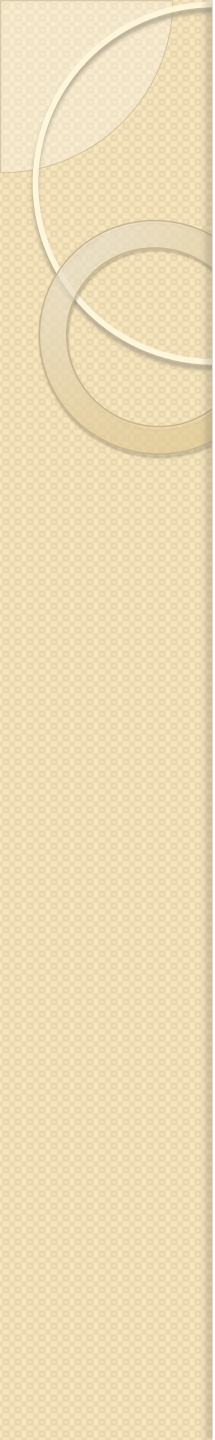
$$\therefore \frac{1}{(x-6)} + \frac{1}{x} = \frac{1}{4}$$

After simplification we get, $x^2 - 14x + 24 = 0$

After factorizing we get $(x-12)(x-2) = 0$

$x = 12, x = 2$, but $x = 2$ is not possible.

\therefore Number of days taken by B to finish the work = 12 .



THANK YOU